

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY
ATLANTA, GEORGIA

HAZARDOUS SUBSTANCES EMERGENCY EVENTS
SURVEILLANCE (HSEES)

FIVE-YEAR CUMULATIVE REPORT
1993-1997
DIVISION OF HEALTH STUDIES
EPIDEMIOLOGY AND SURVEILLANCE BRANCH

In 1980, Congress created the Agency for Toxic Substances and Disease Registry (ATSDR) to implement health-related sections of laws that protect the public from hazardous wastes and environmental spills of hazardous substances. The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), commonly known as the "Superfund" Act, designated ATSDR as the lead agency within the U.S. Department of Health and Human Services to help prevent or reduce further exposure to hazardous substances and the adverse health effects that result from such exposures, and also to expand the knowledge base about such effects.

This publication reports the results and findings of a health study, registry, or other health-related activity supported by ATSDR in accordance with its legislative mandate described above.

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DISCLAIMER

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INTRODUCTION

Since 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) has maintained an active, state-based Hazardous Substances Emergency Events Surveillance (HSEES) system. The purpose of HSEES is to describe the public health consequences associated with the release of hazardous substances and develop strategies to reduce and prevent releases and their associated adverse health effects. Five state health departments participated in the pilot phase of the surveillance system and began data collection on January 1, 1990. During the period 1993–1997, ten states participated in HSEES for the entire time period: Alabama, Colorado, Iowa, New York, North Carolina, Oregon, Rhode Island, Texas, Washington, and Wisconsin. Four states participated during portions of the period considered: Minnesota (1995–1997), Missouri (1994–1997), Mississippi (1995–1997), and New Hampshire (1993–1996). Currently 16 states participate in HSEES. New Jersey and Utah were added to the HSEES system in 2000 and Louisiana was added in 2001. All states that participated in HSEES during 1993–1997 are shown in Figure 1. New Hampshire is not a current participant.

The HSEES system is a computerized database used to monitor the acute public health consequences of emergency releases of hazardous substances into the environment. The system does not study chronic human health effects or the environmental effects of these releases. HSEES is used to describe the morbidity and mortality experienced by employees, responders, and the general public that result from hazardous substances emergency events. The system documents all reportable hazardous

substances releases in participating states except for those involving only petroleum (for example, natural gas, propane, jet fuel, and gasoline). HSEES events can occur at fixed facilities or during transportation.

There are four objectives of the Hazardous Substances Emergency Events Surveillance system. These are:

- To describe the distribution of hazardous substances emergency events within participating states.
- To describe the morbidity and mortality experienced by employees, responders, and the general public that result from emergency releases of hazardous substances.
- To analyze and describe risk factors associated with morbidity and mortality.
- To develop strategies to reduce the subsequent morbidity and mortality.

METHODS

Releases are eligible for inclusion if they are uncontrolled or illegal and require removal, cleanup, or neutralization according to federal, state, or local law. Threatened releases are also included in the system if 1) they involve actions such as evacuations which are taken to protect the public health and 2) they would have required removal, cleanup, or neutralization according to federal, state, or local law. A substance is considered hazardous if it can be reasonably expected to cause injury or death to an exposed person. Releases occurring to air and water that could not be cleaned up are also included in the system if

the amount released would have needed to be cleaned up if the spill had occurred on land.

Data from several sources are used to obtain information about the events. These sources include, but are not limited to, records and oral reports of state environmental protection agencies, police and fire departments, hospitals, corporations, and the media. Data collected on each event include the type of event (fixed-facility or transportation-related event); substance(s) released (identity, chemical form, type of release, and quantity released); victim(s) (population group, type of injury sustained, medical outcome, demographics, personal protective equipment [PPE] worn, and distance from the event); the type of area in which the event occurred; date and time of occurrence; numbers of persons potentially affected; use of environmental sampling; evacuations; response plans; and causal factors.

Emergency events captured by HSEES are classified according to whether they occur at fixed facilities or during transportation. Fixed-facility events involve hazardous substances released at industrial sites, schools, farms, or other permanent facilities; transportation-related events involve hazardous materials released during transport by surface, air, or water.

“Victims” are defined as individuals with symptoms (including psychological stress) or injuries (including death) that result from the event. Victims who receive more than one type of injury are counted once in each applicable type of injury.

Substances are grouped into 11 categories: acids, ammonia, bases, chlorine, mixtures, paints and dyes, pesticides, polychlorinated biphenyls (PCBs), volatile organic compounds (VOCs), other inorganic substances, and other substances. The “mixtures” category consists of chemicals from different categories that are mixed before release, and the “other” category consists of chemicals that cannot be classified into any one of the other 10 chemical categories. The category “other inorganic substances” comprises all inorganic substances except acids, bases, ammonia, and chlorine.

Participating states enter data into a Web-based data entry system. ATSDR performs data management, data analysis, and report generation of the entered data. ATSDR provides each participating state with its own state-level data for analysis and report generation purposes. HSEES data are then used for prevention activities by ATSDR and the participating states.

This cumulative report summarizes the characteristics of hazardous substances releases and the associated public health consequences of events that were reported during the 5-year period 1993 through 1997. Data are presented first for the system as a whole, and then individually by state. A contact name is provided after each state summary as a source for further information. This is followed by a summary of prevention outreach activities performed in 2000 as a result of these findings.

RESULTS

Distribution of Events, by Year, State, and Type

Table 1 shows the breakdown of the 24,359 events reported to HSEES for 1993–1997 by type of event and state. Texas reported 40% of all total events (n=9,817); and New Hampshire reported the smallest percentage, 0.7% (n=181). Fixed-facility events represented 80% (n=19,490) of all reported events. Only 20% (n=4,869) of all events were transportation related. The number of transportation-related events was likely underestimated because direct connections with the U.S. Department of Transportation's Hazardous Materials Incident Reporting System (HMIRS) were not established until 1998. During 1993–1997, the percentage of fixed-facility events differed considerably by state. Texas had the largest percentage (91%) and Missouri the smallest (60%).

Temporal Patterns of Events

The number of events increased each year from 1993 through 1997 (Figure 2), essentially because of increases in the number of participating states and the number of reporting sources. However, even when states that did not participate for the full time period were excluded, the number of events per year still increased from 3,775 in 1993 to 5,401 during 1997.

The frequency of both transportation-related and fixed-facility events during 1993–1997 was highest during April–August, with a peak occurring in May (Figure 3). This peak coincides with the agricultural planting season, when demand for agricultural chemicals is high.

Both fixed-facility and transportation-related events occurred more frequently on weekdays (Monday–Friday), than on Saturdays and Sundays (Figure 4); events were most likely to occur on Wednesdays.

Figures 5 and 6 illustrate the distribution by time of day for occurrence of fixed-facility and transportation-related events. Most events (68.9% [n=12,930] of fixed-facility and 73.4% [3,262] of transportation-related events) occurred between the hours of 6 AM and 6 PM. Both fixed-facility and transportation-related events peaked at 10 AM. A lull in fixed-facility events occurred at 12 PM, which coincides with the typical lunch hour.

Chemicals

The 10 most frequently released chemicals were ammonia (n=1,827, 6.7%), sulfur dioxide (n=1239, 4.5%), sulfuric acid (n=913, 3.3%), ethylene glycol (n=825, 3.0%), sodium hydroxide (n=705, 2.6%), hydrochloric acid (n=699, 2.5%), PCBs (n=701, 2.6%), chlorine (n=662, 2.4%), paint or coating, not otherwise specified (NOS) (n=451, 1.6%), and benzene (n=448, 1.6%). Of the 11 categories into which HSEES substances were grouped, the categories of chemicals most commonly released in all events were “other” (n=6,186, 22.6%), “other inorganic substances” (n=5,175, 18.9%), and “volatile organic compounds” (n=4,967, 18.1%) (Table 2).

Fixed-Facility Events

The largest percentage (36.5%, n=6,374) of fixed-facility industry-related events involved releases from processing vessels used at industrial facilities. Other prime

locations for the occurrence of events were piping (16.7%, n=2,918), material loading and unloading sites (13.1%, n=2,280), and above-ground storage areas (13.6%, n=2,374). Information about causal factors of events was not collected by HSEES until 1995. Of the 9,987 events with causal information, the most frequent factors were equipment failure (67.6%, n=6,754) and operator error (19.6%, n=1,958). The most frequently released substances at fixed-facility events were in the categories “other” (21.4%, n=4,702), “other inorganic substances” (20.4%, n=4,486), “volatile organic compounds” (19.7%, n=4,341), and “acids” (8.6%, n=1,890).

Transportation-related events

Eighty-one percent of transportation-related events occurred during ground transport, 13% during rail transport, and 6%, combined, for air, pipeline, water, or other type of transport. The most frequently released substances during transportation-related events are in the categories “other” (27.3%, n=1,484), “pesticides” (15.8%, n=862), “other inorganic substances” (12.7%, n=689), and “acids” (12.6%, n=683).

Victims

There were 8,397 victims as a result of fixed-facility events and 1,216 victims as a result of transportation-related events. For both transportation-related and fixed-facility events, “employees and students” (55.9%, n=5,377) was the population group most often injured, followed by “the general public” (34.5%, n=3,317) and “first responders” (9.2%, n=882). The category of victim was not known for 37 persons. Because “students” were

counted in the “employee” population group until they became a separate category in 1996, their numbers are presented together. Of the first-responder group, professional firefighters, police, and volunteer firefighters were the most frequent victims of fixed-facility events; police were the most frequent victims of transportation-related events.

Ninety-four percent of all events reported to HSEES involved the release, or threatened release, of only one hazardous substance, 5% involved two or three substances, and only 1% involved four or more substances. The categories “other,” “other inorganic substances,” and “acids” were most frequently involved in events with victims. Although volatile organic compounds were released in a large percentage of total events, they were less frequently released in events involving victims. Acids, ammonia, chlorine, and pesticides (easily dispersed respiratory irritants) were more frequently represented among events involving victims than among total events.

Respiratory irritation (36.7%, n=6,002) was the most commonly reported injury for both types of events. Other common injuries were eye irritation (14.7%, n=2,412), gastrointestinal irritation and vomiting (13.8%, n=2,252), headache (11.2%, n=231), dizziness and other central nervous system effects (8.0%, n=1,316), skin irritation (5.4%, n=885), trauma or physical injury (3.2%, n=530), and chemical burns (2.9%, n=468). A high percentage of trauma injuries (18.9%, n=358) were reported in transportation-related events because collision-related injuries were not excluded. Most victims were treated at a hospital for their injuries and released (64.8%, n=6,225), treated on the scene (16.6%, n=1,592), or brought to a

hospital for observation but did not require treatment (6.7%, n=646). Very few victims (a) sought no immediate care or sought care from a private physician (4.5%, n=436), (b) were admitted as an inpatient to a hospital (6.1%, n=583), or (c) died from their injuries (1.1%, n=110). The severity of injury to 21 (0.2%) of reported victims is unknown.

Deaths

A total of 110 deaths were reported to HSEES during 1993–1997 (66 in transportation-related and 44 at fixed-facility events). Forty-seven of the transportation-related victims experienced trauma-related injuries at events where no explosion was reported. Motor vehicle collisions likely were responsible for those 47 deaths, rather than hazardous substances. The remaining 63 deaths considered to be related to the release of hazardous substances (including 16 from explosion-related events) were evaluated further.

The 63 deaths occurred as the result of 26 fixed-facility and 10 transportation-related events. Thirteen (20.6%) were in a farming-related industry (eight occurred at fixed-facilities and five during transportation). Four (6.3%) of the 63 fatalities were first responders, all of which resulted from one event.

Evacuation Orders

Eleven percent (n=2,676) of events involved an official evacuation order. The number of persons evacuated ranged from one to more than 10,000. Fifty percent of the

evacuations involved 20 or fewer persons, 75% involved 68 or fewer persons, and only 2% involved 1,000 or more persons.

Decontamination

A total of 9,869 decontaminations were performed at HSEES events on 2,162 employees at the scene (406 at a medical facility), 5,637 first responders at the scene (259 at a medical facility), and 992 members of the general public at the scene (413 at a medical facility). First responders represent the group most frequently decontaminated on the scene and least frequently decontaminated at a medical facility. Some persons might have been decontaminated at both locations.

DISCUSSION

HSEES has recorded data on a large number of events for the period 1993–1997. Data analyses indicate that the majority of events occurred at fixed facilities and that most occurred during normal business hours (6 AM to 6 PM). Because operator error and equipment failure were significant contributors to the releases, it is important that workers be trained to safely handle hazardous substances and that employers be conscious of the ramifications of inadequate equipment maintenance.

Handlers and users of substances (e.g., acids, ammonia, chlorine, and pesticides) that frequently cause injury when released should be targeted for prevention messages. Because respiratory irritation is the most commonly reported injury, employees and responders

should be trained to use appropriate personal protective equipment, particularly respiratory protection. Firefighters are frequently injured at fixed-facility events. Firefighter turnout gear, which is designed for fighting structural fires, is normally worn; however, it is not chemically resistant and does not require respiratory protection. Police officers, who also are frequently injured at transportation-related events, may not be routinely provided with any protective equipment or with hazardous substance training.

Events reported to HSEES follow a seasonal pattern. Events increase at times when agricultural activities (e.g., planting, fertilizing, and applying pesticides) are being performed. Agricultural workers frequently use hazardous chemicals, namely ammonia and pesticides. Also, many deaths at HSEES recorded events were among agricultural employees. Therefore, states with a large agriculture industry should consider safety training targeted specifically for agricultural employees and those who transport agricultural chemicals.

During 1993–1997, many victims were treated and many decontaminations were performed at hospital emergency rooms. This emphasizes the need to provide training to emergency room personnel in recognizing the signs and symptoms of contaminated patients, properly treating them, and following proper isolation and decontamination procedures. If contaminated patients are not properly identified or treated, the results can be significant, possibly causing loss of life or causing a temporary closing of an emergency room.

TABLES AND FIGURES

Table 1. Number of events, by state and type of event—Hazardous Substances Emergency Events Surveillance, 1993–1997.*

State	Type of event		Total
	Fixed-facility No. (%)	Transportation-related No. (%)	
Alabama	685 (80.8)	163 (19.2)	848
Colorado	1,335 (69.2)	595 (30.8)	1,930
Iowa	1,007 (66.3)	511 (33.7)	1,518
Minnesota	611 (76.9)	184 (23.1)	795
Mississippi	241 (68.5)	111 (31.5)	352
Missouri	517 (60.3)	341 (39.7)	858
New Hampshire	152 (84.0)	29 (16.0)	181
New York	1,624 (82.8)	337 (17.2)	1,961
North Carolina	805 (74.5)	276 (25.5)	1,081
Oregon	673 (72.3)	258 (27.7)	931
Rhode Island	199 (87.3)	29 (12.7)	228
Texas	8,909 (90.8)	908 (9.2)	9,817
Washington	1,509 (74.6)	513 (25.4)	2,140
Wisconsin	1,223 (66.6)	614 (33.4)	1,837
Total	19,490 (80.0)	4,869 (20.0)	24,359

*Numbers in the table may differ slightly from those reported by individual states because of adjustments made by the states after submission of the data to ATSDR. Additionally, not all states participated for the entire 1993–1997 time-frame.

Table 2. Substances released, by substance category and type of event—Hazardous Substances Emergency Events Surveillance, 1993–1997.

Substance category	Type of event		Total
	Fixed-facility No. (%)	Transportation-related No. (%)	
Acids	1,890 (8.6)	683 (12.6)	2,573 (9.4)
Ammonia	1,592 (7.2)	235 (4.3)	1,827 (6.7)
Bases	723 (3.3)	336 (6.2)	1,059 (3.9)
Chlorine	631 (2.9)	31 (0.6)	662 (2.4)
Mixtures*	1,573 (7.2)	201 (3.7)	1,774 (6.5)
Other inorg. substances	4,486 (20.4)	689 (12.7)	5,175 (18.9)
Other substances	4,702 (21.4)	1,484 (27.3)	6,186 (22.6)
Paints and dyes	373 (1.7)	244 (4.5)	617 (2.3)
Pesticides	1,016 (4.6)	862 (15.8)	1,878 (6.8)
PCBs	653 (3.0)	48 (0.9)	701 (2.6)
VOCs	4,341 (19.7)	626 (11.5)	4,967 (18.1)
Total	21,980 (100.0)	5,439 (100.0)	†27,419 (100.0)

* Mixtures of substances from other categories

Inorg.=inorganic, PCBs=polychlorinated biphenyls, VOCs=volatile organic compounds

†The number of substances does not equal the number of events because some events have multiple substances released.

Figure 1. States participating in the Hazardous Substances Emergency Events Surveillance system, 1993–1997.

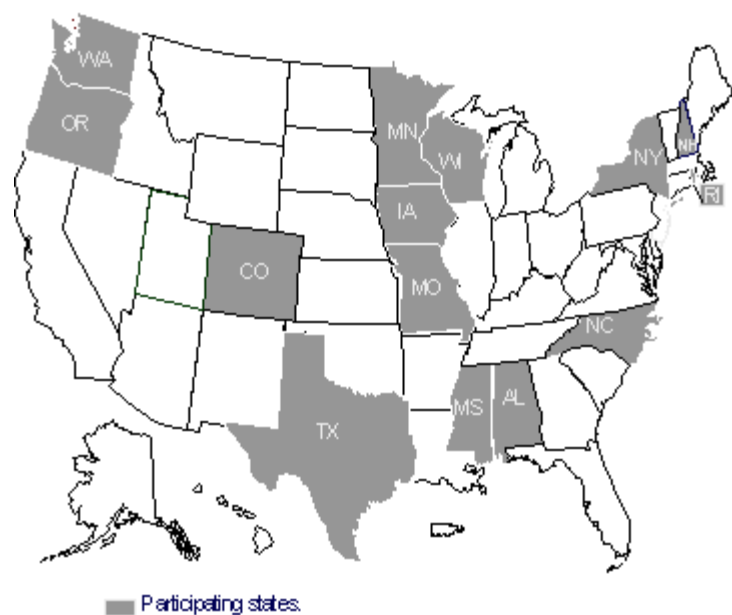


Figure 2. Events reported to the Hazardous Substances Emergency Events System, by year and type of event, 1993–1997.

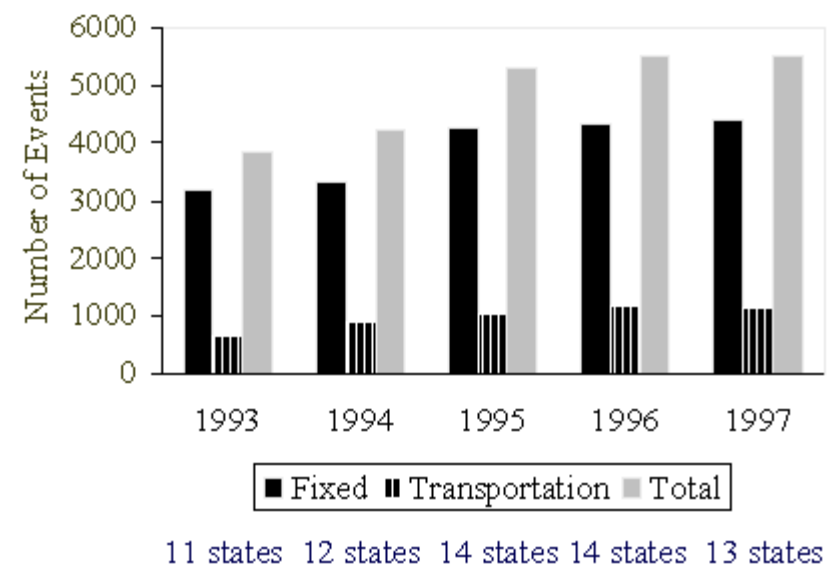


Figure 3. Events reported to the Hazardous Substances Emergency Events Surveillance system, by month and type of event, 1993–1997.

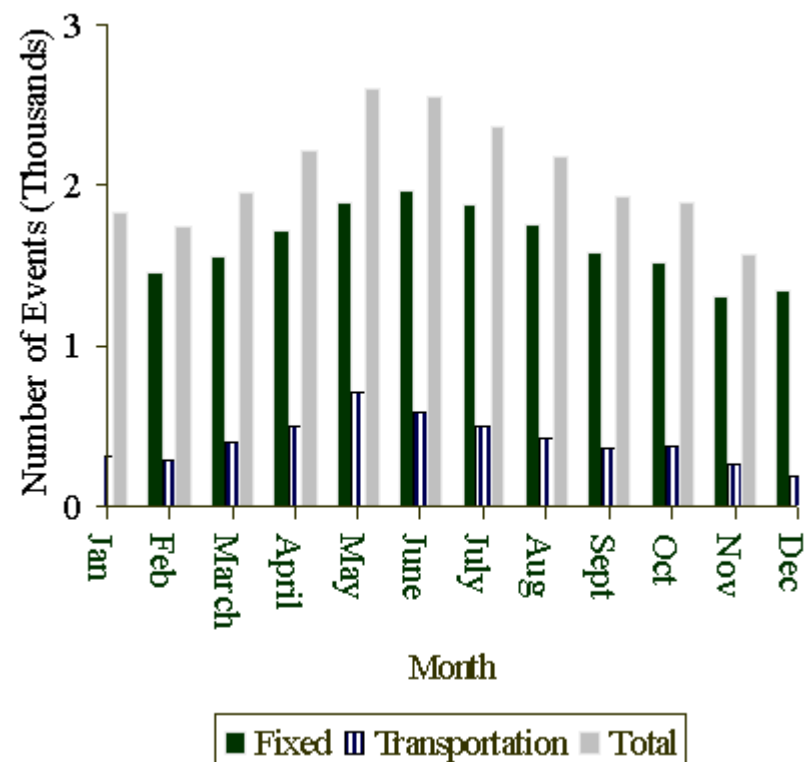


Figure 4. Events reported to the Hazardous Substances Emergency Events Surveillance system, by day of the week and type of event, 1993–1997.

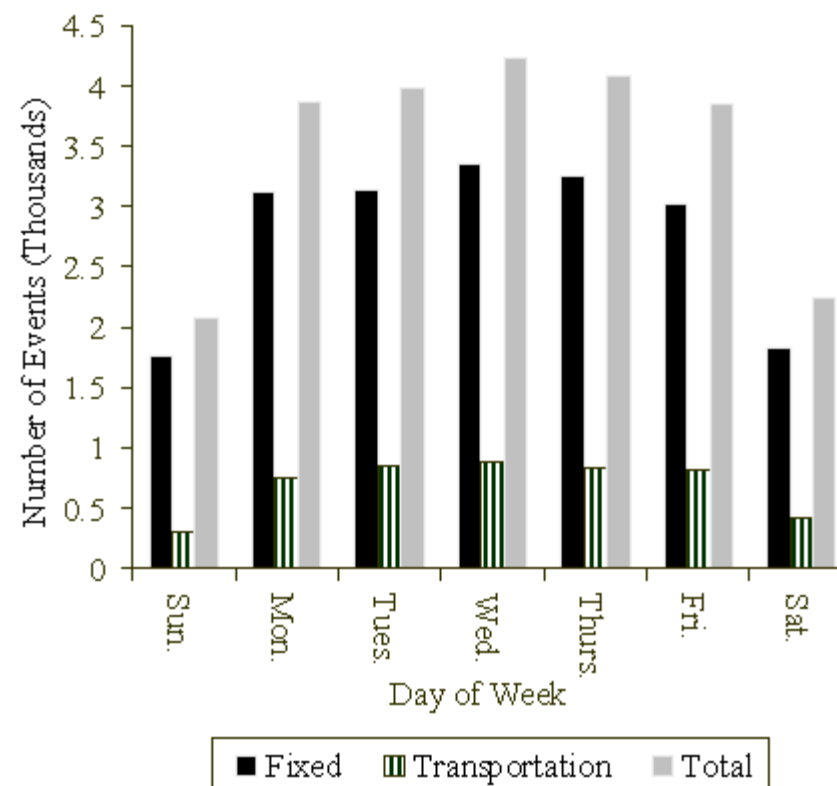


Figure 5. Fixed-facility events reported to the Hazardous Substances Emergency Events Surveillance system, by time of day, 1993–1997.

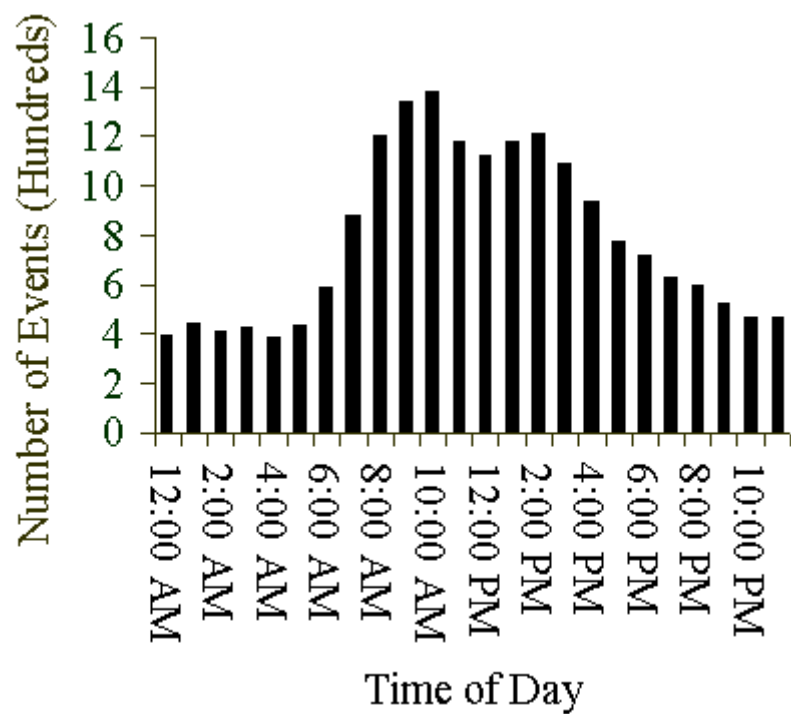
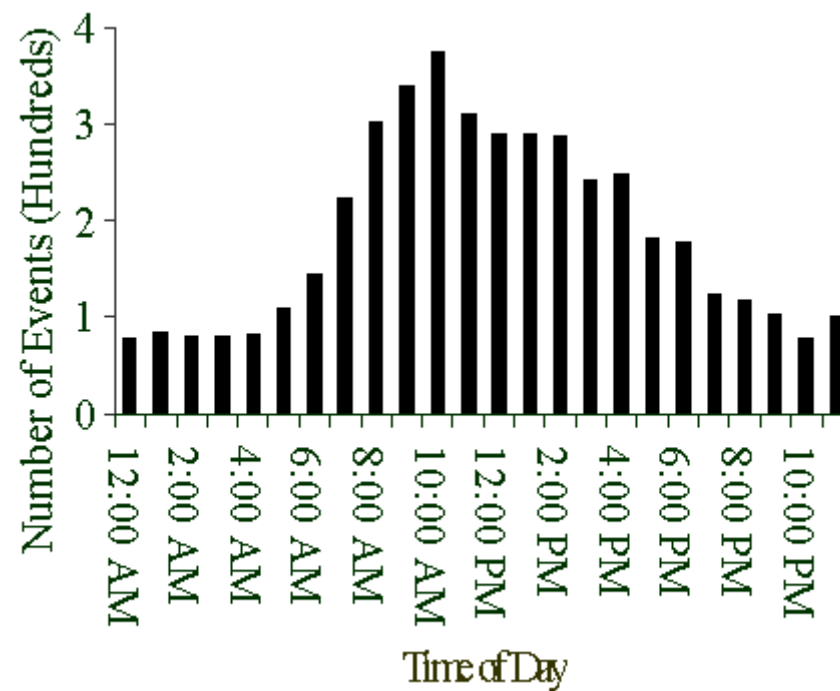


Figure 6. Transportation-related events reported to the Hazardous Substances Emergency Events Surveillance system, by time of day, 1993–1997.



ALABAMA

From 1993 to 1997, the Alabama Hazardous Substances Emergency Events Surveillance (HSEES) system identified and investigated 848 events meeting study criteria, an average of 170 events per year. Eighty-one percent (n=685) of events occurred at fixed facilities, and 19% (n=163) were transportation-related.

A total of 361 victims were injured in 103 individual events. Respiratory irritation was the most commonly reported type of injury for both fixed-facility and transportation-related events. Four deaths were recorded.

The 10 most frequently released chemicals were ammonia (n=67), chlorine (n=51), sodium hydroxide (n=42), sulfuric acid (n=40), sulfur dioxide (n=37), methyl mercaptan (n=29), hydrochloric acid (n=25), PCBs (n=21), potassium hydroxide (n=15), and ethylene glycol (n=15).

Chlorine displayed a marked tendency to cause symptoms upon exposure. Although events involving chlorine comprised 17.4% of the total number of events in which injuries occurred, only 5.6% of all events involved chlorine releases. The tendency for injury to occur during chlorine releases (39.2%) was more than twice that of ammonia (19.3%) and acids (16.8%).

Evacuations were ordered in 115 (13.6%) events. The median number of people evacuated was 50. The maximum number of people evacuated in a single event was just under 2,000.

The state's two most populous counties, Jefferson and Mobile, had the greatest number of hazardous substance releases (109 and 184 releases, respectively). Event notifications and data were obtained from the Alabama Department of Environmental Management, the U.S. Department of Transportation, the National Response Center, state and local emergency management agencies, local fire departments, media reports, poison information centers, the Alabama Cooperative Extension Service, medical records, and state industries involved in the releases.

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COLORADO

During the 5-year period 1993–1997, 1,930 hazardous substance events qualified for inclusion in the Colorado HSEES System. A total of 1,335 (69.2%) events were at fixed facilities, and 595 (30.8%) events were transportation related. Most fixed-facility events occurred during material handling (i.e., loading/offloading). The most common factor contributing to the release of substances at fixed-facility events was operator error (60.4%). The majority of transportation-related events in Colorado occurred during ground transport (81.3%).

Ninety-seven percent of events in Colorado involved the release of only one substance. Most releases were liquid spills (83%). The 10 most frequently released chemicals were ethylene glycol (205 events), ammonia (91), sulfuric acid (84), sodium hydroxide (77), mercury (70), hydrochloric acid (70), corrosive NOS (68), ethanol (59), phosphoric acid (51), and methanol (45). The large number of ethylene glycol events is directly attributable to the previous inclusion of motor vehicle radiator events in the HSEES.

A total of 351 victims were involved in 116 events (6% of all events). Of the 116 events with victims, 55.2% involved only one victim. Victims sustained a total of 526 injuries, 378 in fixed-facility events and 148 in transportation-related events. Some victims had more than one injury. The most commonly reported injury in fixed-facility and transportation-related events was respiratory irritation. Eight deaths were reported. The population group most often injured was employees.

The substances released most often were not necessarily the most likely to result in injury. For example, volatile organic compounds were released during 377 events. However, only 17 (4.5%) of these events resulted in injury. Although chlorine was released in only 20 events, six (30%) of these events resulted in injury, indicating its greater potential for immediate harm. The substance with the second highest percentage of releases with victims was ammonia.

Evacuations were ordered in 185 events. Eighty-one percent of the evacuations were of a building or the affected part of a building. The average number of people evacuated was 47, with a minimum of one and a maximum of 2,080. Mercury and ammonia were the two substances released most often where an evacuation was ordered. In-place sheltering was only ordered once.

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IOWA

Iowa was one of five state health departments that participated in the pilot phase of HSEES beginning January 1, 1990. From January 1, 1993, through December 31, 1997, project staff reviewed 3,960 actual and threatened chemical releases reported to the Iowa Department of Natural Resources. These releases were investigated through telephone and written inquiries and reports.

A total of 1,518 releases met the HSEES case definition (66% at fixed facilities and 34% transportation related). In comparison with other participating states, Iowa had the second highest percentage of transportation-related events, which may be due to the two major interstate highways and the amount of agricultural chemicals being transported. Eighty-seven percent of transportation-related events involved motor vehicle ground transportation.

Equipment failure and operator error were responsible for 81% of the fixed-facility events. Most events (96%) involved a single hazardous substance being released. A total of 1,664 chemicals were released. The most frequently released chemicals were agriculture related; 407 (24.5%) were pesticides and 299 (18.0%) were ammonia. The chemicals most frequently released in descending order were ammonia, nitrogen fertilizer, PCBs, NPK fertilizer, hydrochloric acid, sulfuric acid, pendimethalin, paint or coating NOS, ethylene glycol, and pesticide NOS.

During 1993–1997, a total of 402 victims (including 9 deaths) sustained a total of 617 injuries. The most

commonly reported injuries were respiratory irritation, eye irritation, nausea, and headaches. The population groups most often injured were employees (67.7%), followed by the general public (25.1%) and emergency responders (7.2%). Although most (82%) of the people who were injured were transported to a hospital, only 9% had injuries severe enough to be admitted. The chemicals most frequently causing injury were ammonia, pesticides, other inorganic substances, and acids.

Of the 1,518 events, an official evacuation was ordered for 102 (6.7%); 58 (56.9%) of which were from buildings or the affected part of buildings, 26 (25.5%) were based on actual or anticipated downwind dispersion, 14 (13.7%) were of a defined circular area around an event, and four (9.3%) were ordered without evacuation criteria. The median number of people evacuated was 42, and the largest number was 1,200.

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MINNESOTA

During 1995–1997, the Minnesota HSEES system recorded 795 emergency events. Of these 795 events, 60 resulted in injuries to 264 people, including one death. These people reported a total of 497 injuries. The most common injuries were respiratory irritation, gastrointestinal problems, headache, and eye irritation. Of the 60 events with victims, 87% had three or fewer victims. There were 99 events with evacuations; these 99 evacuations involved more than 5,122 people.

There were 1,010 chemicals released in the 795 events. The most frequently released chemicals were ammonia (anhydrous and aqueous) (10%), sulfuric acid (4%), and PCBs (3%). Most events (92%) involved the release of only one chemical. Excluding one event at which 99 chemicals were released, the most commonly reported category of chemicals was pesticides. Additional research is needed to determine which chemicals are resulting in the most injuries and what can be done to minimize the injuries from these chemicals.

Agriculture (associated with 27% of all events) uses a large amount of hazardous substances during the spring planting season. There was a corresponding increase in the number of hazardous substances releases during the spring in both fixed-facilities and transportation-related events. The use of agricultural products during the spring planting season greatly increased the number of events occurring in April, May, June, and July. During these 4 months, 82% of all agricultural events occurred.

Nonagricultural events exhibited a typical business cycle both by day of the week and hour of the day. There were twice as many events per day on workdays as on weekends. Most events occurred from 6 AM to 6 PM. Transportation-related events were highest on Tuesday, Wednesday, and Thursday. Half of the events occurred in the 10 “urban” counties. The other half of the events occurred in the 77 “rural” counties.

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MISSISSIPPI

The Mississippi State Department of Health (MSDH) began participating in the HSEES on January 1, 1995. From then through 1997, project staff reviewed 2,454 actual and threatened spills/air releases and identified 352 events (14.3%) that involved non-petroleum substances and met the study criteria. These spills and air releases were investigated through telephone and written inquiries to appropriate sources, including state environmental agencies, state emergency management agencies, local fire and police departments, civil defense/emergency planning agencies, hospitals, and the industries involved.

Of the 352 events, 68% (n=241) occurred at fixed-facilities and the remaining 32% (n=111) occurred during transport. Of the transportation-related events, 88 (79%) involved a motor vehicle (truck, van, tractor, or automobile).

The chemicals most frequently released were, in descending order, ammonia, chlorine, paint or coating NOS, benzene, titanium, and tetrachloride. Most (n=326, 93%) events involved a single hazardous substance, 6% (n=22) involved two hazardous substances, and 1% (n=4) involved three to seven hazardous substances.

Evacuations, which were ordered in 51 events, resulted in 15,181 people leaving their home or work as a direct result of a hazardous substance release. The chemicals most frequently associated with evacuations were ammonia, multichemical releases, chlorine, freon NOS, hydrochloric acid, and malathion.

A total of 327 people were injured in 41 events. The most common injuries were respiratory irritation, nausea or vomiting, headache, dizziness or other central nervous system symptoms, and eye irritation. The chemicals most frequently causing injury were ammonia, multichemical releases, chlorine, and formaldehyde. Fifty percent (n=162) of injured persons were employees. Most (88%) injured people were transported to hospitals and released after treatment. Five fatalities were recorded; all were the result of trauma during transportation-related events.

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MISSOURI

The Missouri Department of Health (MDOH) began collecting data January 1, 1994; therefore the 5-year data analysis period was 1994–1998. During this time 1,071 events, 676 (63.1%) in fixed facilities and 395 (36.9%) transportation related, were investigated and reported. Events were scattered throughout the state, occurring in 100 (87.7%) of the 114 counties and St. Louis City. Seven of the 10 counties with the highest number of events are adjacent to or are included in a major metropolitan area. These seven counties accounted for 553 (51.6%) of events.

Although many (221, 32.7%) of the fixed-facility events involved equipment failure, 94 (13.9%) involved operator error, and 17 (2.5%) improper filling/overfilling of chemical containers. The most common areas involved in fixed-facility events included above-ground storage (147, 21.7%) and piping (125, 18.5%). Ground transportation accounted for 337 (85.3%) and rail transportation 48 (12.2%) of transportation- related events.

Most (1,060, 99.0%) events involved the actual release of one or more hazardous substances, with the majority (985, 92.9%) involving only one substance. Of the 1,179 substances released, the most frequently released was ammonia (136, 11.5%) followed by sulfuric acid, PCBs, ethylene glycol, and hydrochloric acid.

A total of 151 victims sustained single or multiple injuries in 66 (6.2%) events involving an actual release. Forty events (60.6%) involved only one victim. Most (111, 73.5%) victims were injured in fixed-facility events. Fifty-

two victims (34.4%) were treated at a hospital but not admitted, 42 (27.8%) were treated at a hospital and admitted, and 41 (27.2%) were treated at the scene. Seven events resulted in seven deaths, all of whom were categorized as employees. The most common types of injuries were respiratory irritation, eye irritation, and gastrointestinal symptoms in fixed-facility events and trauma and respiratory irritation in transportation-related events. The substances most frequently associated with injuries were chlorine, ammonia, and acids.

Evacuations were ordered in 98 (9.2%) events. Of the seventy-one evacuations with known number of evacuees, there is a total of 11,296 people were evacuated. During 14 additional events, an unknown number of individuals left their home or place of business without an official evacuation order. Substances most frequently associated with evacuations (in descending order) were ammonia, mercury, hydrochloric acid, and chlorine.

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NEW YORK

Since January 1, 1992, the New York State Department of Health (NYSDOH) has participated in the HSEES system. For the period 1993–1997, project staff reviewed approximately 85,000 actual and threatened spills/air releases reported in New York State and identified 1,956 (2.3%) events that met the project criteria.

Eighty-three percent (1,620) of the HSEES events occurred at fixed facilities and 17% (336) occurred during transport. Of the transportation-related events, 296 (88%) involved a motor vehicle. Most (1,768, 90%) events involved a single hazardous substance; 9% involved two or three hazardous substances; and 1% involved four to eleven hazardous substances. HSEES events were associated with 297 ordered evacuations of 19,489 people.

The 10 chemicals most often released in reported events were, in descending order, ethylene glycol, sulfuric acid, oils (heat transfer fluids) containing low levels of PCBs, hydrochloric acid, ammonia, chlorine, mercury, chlorodifluoromethane, sodium hydroxide, and sodium hypochlorite. Chemicals most frequently associated with injuries were hydrochloric acid, sodium hypochlorite, chlorine, and ammonia. Ammonia, chlorine, hydrochloric acid, and sulfuric acid were the most frequently associated with evacuations.

A total of 718 people were injured in 274 events. The most common injuries were respiratory irritation, dizziness and other central nervous system symptoms, and nausea or vomiting. Most (70%) injured people were

transported to hospitals and released after treatment, but 10 persons died. No personal protective equipment was worn by 72% of injured employees and 35% of injured responders. There were 1,282 decontaminations, the majority of them (91%) on-scene.

The ten chemicals most frequently associated with injuries accounted for 58% of the injured people, most of whom were categorized as employees (60%). The most frequent injury was respiratory irritation. One-fourth of the events resulting in injury involved ordered evacuations, the majority (54%) with 30 or fewer people being evacuated. Many of the events resulting in injury occurred in industrial (48%) or commercial (31%) areas, and a high percentage (62%) were also near residences. For the 10 chemicals most frequently involved in injuries, the most frequent sites of spills/releases were “piping” (34%) and “storage above ground” (22%).

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NORTH CAROLINA

A total of 1,081 events were reported to the North Carolina HSEES system from 1993 through 1997. Of these events, 74.5% (n=805) were fixed-facility events and 25.5% (n=276) were transportation-related.

Areas involved in fixed-facility events were storage above ground (n=212), process vessels (n=174), piping (n=132), material handling (n=118), and transportation within the fixed facility (n=79). The majority of transportation-related events occurred during ground transport (n=252, 91.3%). Transport by rail accounted for 19 events (6.9%), with the remaining five (1.8%) transportation-related events involving water, air, or other.

The majority of events (n=1,019, 94.3%) involved the release of only one substance. The 10 most frequently released chemicals were ammonia (n=70), chlorine (n=61), ethylene glycol (n=56), sulfuric acid (n=49), hydrochloric acid (n=47), paint or coating NOS (n=39), sodium hydroxide (n=39), PCBs (n=23), formaldehyde (n=21), and phosphoric acid (n=19). Chlorine releases had the highest percentage of releases with victims (34.4%), followed by other inorganic substances (29.0%).

A total of 575 victims were involved in 182 events (16.8% of all events). The victims sustained a total of 987 injuries. Some victims had more than one injury. The most commonly reported injury in fixed-facility events was respiratory irritation. Trauma was the most commonly reported injury in transportation-related events. The population group most often injured were employees

(n=433, 75.3%), followed by the general public (n=63, 10.9%).

Evacuations were ordered in 241 (22.3%) events. A total of 18,600 people were evacuated; most (n=15,984, 85.9%) people were evacuated because of fixed-facility events.

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OREGON

Oregon has participated in the HSEES system since 1992. Project data for 1993–1997 provide a comprehensive picture of hazardous substance emergencies (and threatened emergencies) in the state, and the resulting morbidity and mortality. The Oregon Emergency Response System (OERS) and the Office of State Fire Marshal (OSFM) record incident reports, but they do not record the human health effects of hazardous substances emergencies or determine the relevance of the individual reports to HSEES criteria. The HSEES project obtains the incident reports and follows up to identify human health effects and the potential for human health effects through individual contacts and investigations.

The focus on human health effects has resulted in the identification of trends in morbidity and problems encountered in response to hazardous substance emergencies. Educational programs have been developed for presentation to appropriate audiences to address these response issues and reduce future injuries. Data generated by Oregon's HSEES have been requested by Oregon emergency planners, first responders, and those in private industries who manufacture, ship, store, or use hazardous substances in their places of work.

Limitations of surveillance systems are attributable to gaps in reporting and incomplete mechanisms for feedback to contributors. Oregon HSEES has identified reporting gaps, which has led to improved reporting of certain hazardous material (HazMat) events. OERS and OSFM personnel have observed that reporting has

improved during the past 7 years. Oregon's experience in collecting HSEES data has been enhanced by the Oregon Health Division's understanding of surveillance needs, limitations, and experiences with other surveillance systems. Several consistent patterns have emerged:

- Most (72%) events have occurred at fixed facilities, and most (90%) involved the release of only one substance.
- Eighteen percent of the events involved injuries.
- 56% of the victims were in the employee category.
- Forty-two percent of victims were treated at the hospital but not admitted; 16% were treated on-scene; and 5% required hospital admission.
- Respiratory irritation (48%) was the most frequently reported injury among all victims; however, 64% of employees who experienced respiratory irritation were wearing no personal protective equipment.
- Ammonia and chlorine were the most frequently released chemicals and were most frequently associated with evacuations.
- Evacuations were ordered for 26% of events.

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RHODE ISLAND

During 1993–1997, the Rhode Island Department of Health (HEALTH) worked with the ATSDR to maintain an active HSEES system to describe the public health consequences associated with the release of hazardous substances. This report summarizes the characteristics of events that met the HSEES reporting criteria during the 5-year period.

Several data sources were used to obtain the maximum amount of information about each event. These sources included records or oral reports of the Rhode Island Department of Environmental Management, local police and fire departments, the companies and institutions involved, and hospitals.

HEALTH reported a total of 228 events during the reporting period. Approximately 87% of events occurred at fixed facilities, and 13% were transportation related. In 89% of events, only a single substance was released.

The most commonly reported categories of substances were other inorganic substances, the category designated “other,” and acids; these categories accounted for approximately 60% of the total substances released. Volatile organic compounds, ammonia, paints and dyes, bases, chlorine, pesticides, PCBs, and mixtures involving more than one category accounted for about 40% of the total substances released, with no single category responsible for more than 7.5%.

During this reporting period, 38 (16.7%) events resulted in a total of 173 victims. The most frequently reported (approximately 69%) injuries were respiratory irritation, nausea, and eye irritation. One person died as a result of all events. Seventy-five events required evacuations. The median number of persons evacuated was 20 (range: 1–1,600 persons).

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TEXAS

The Texas Department of Health has participated in the HSEES system since January 1, 1993. During 1993–1997, approximately 17,557 notifications of actual and threatened chemical spills and air releases were reported in Texas of which 9,817 (56%) met the HSEES case definition. These events were investigated through telephone, fax, and written inquiries to appropriate sources including local, county, and state emergency response personnel (e.g., firefighters and HazMat staff, county health departments, industrial health and safety personnel, plant managers and employees, and private citizens).

Of the 9,817 events, 8,909 (90.8%) occurred at fixed facilities and 908 (9.2%) occurred during transport. Of the transportation-related events, 580 (63.9%) involved a motor vehicle (truck, van, tractor, or automobile).

In most (n=9,294, 94.7%) events, only one hazardous substance was involved with 419 (4.3%) events involving two or three substances and 104 (1.0%) involving four to 44 separate hazardous chemicals for a total of 10,876 substances. Evacuations were ordered in 421 events, involving the evacuation of more than 52,068 people (77 events were missing the number of people evacuated).

The 10 chemicals most frequently released were sulfur dioxide (n=935, 8.6%), benzene (n=414, 3.8%), ammonia (n=345, 3.2%), butadiene (n=314, 2.9%), sulfuric acid (n=302, 2.8%), sodium hydroxide (n=239, 2.2%), hydrogen sulfide and sulfur dioxide mixed (n=210, 1.9%), ethylene (n=203, 1.9%), hydrogen sulfide (n=200, 1.8%),

and ethylene glycol (n=183, 1.7%). The chemicals most frequently associated with events involving injury were ammonia (20 events), chlorine (17), sulfuric acid (16), hydrochloric acid (12), and sodium hydroxide (10). The three events with the largest number of people injured involved ammonia (583 people), sodium hydroxide (251), and aldicarb (136). Ammonia (62), chlorine (21), sulfuric acid (16), and hydrochloric acid (14) were most frequently associated with ordered evacuations.

A total of 2,507 persons (712 (28.4%) employees, 153 (6.1%) responders, 1,627 (65.0%) general public and 15 unknown category) were injured. The most common injuries were respiratory irritation, eye irritation, and nausea or vomiting. Most (n=1,894, 75.6%) injured persons were transported to a hospital and released after treatment. Forty-three (1.7%) persons died, 23 at fixed-facility events and 20 from trauma during transportation-related events. No personal protective equipment was worn by 274 of the injured employees and 69 of the injured responders.

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WASHINGTON

Washington State Department of Health (DOH) has participated in the HSEES system since 1992. More than 50,000 reports were received by DOH during 1993-1997. Of these, 2,022 met the HSEES case definition; 1,974 were actual releases and 48 were threatened releases. One of the actual releases included both an actual and threatened release of hazardous substances. Seventy-five percent of the actual releases occurred at fixed facilities and 25% occurred during transport. Most transportation-related events involved ground transport (75.4%), followed by rail (15.0%), water (7.1%), and air (2.2%) transport. Releases were most apt to occur in industrial or commercial settings.

There were 2,654 victims associated with 457 “victim events” (events involving victims). Persons categorized as employees (n= 1,656) were most often injured, followed by general public (809) and responders (189). There were 486 events where evacuations were ordered. There were 37,673 people evacuated in 397 of the events; the number of people evacuated was unknown for 89 events. The industries with the highest numbers of releases did not have the highest number of victims, except for the industry category “manufacture of non-durable goods,” which had 24.5% of the incidents and was ranked fifth for number of victims (n= 230).

The injuries most frequently reported, in descending order, were respiratory irritation, eye irritation, headache, and nausea or vomiting. Most (n= 1,660) victims were transported to the hospital for treatment; 580 victims were treated at the scene. Fifteen men died, including one man

who died in a traffic incident that occurred during a threatened release. There were 48 threatened releases with 15 evacuations of 774 people. Six persons were injured in five threatened events, all of which were transportation related.

Ninety-four (n= 1,847) percent of events involved the release of a single substance, 4.7% (n = 93) of events involved two or three substances, and 1.7% (n = 34) of events involved four or more substances. The top three chemicals released were ammonia, PCBs in oil, and sulfur dioxide. The three chemicals most often associated with victim events and evacuations were ammonia, chlorine, and o-chlorobenzylidene malononitrile (pepper gas). Ammonia, pepper gas, and carbon monoxide were most often associated with victims. Most of the victims of ammonia and pepper gas releases were members of the general public. Employees, including students, were more often the victims of chlorine releases.

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WISCONSIN

Since 1991, the Wisconsin Division of Public Health (DPH) has participated in the HSEES system. During (1993–1997), a total of 1,837 hazardous events met the HSEES case definition. Of these, 1,223 (67%) events occurred at fixed facilities, and 614 (33%) were transportation related. Of the fixed-facility events, approximately 25% were reported as involving piping, 24% involved process vessels, and 20% involved above-ground storage facilities. More than 94% of the transportation-related events were associated with ground transport (e.g., in a truck, van, tractor, or trailer). Less than 3% of transportation-related events involved railroad transport.

A total of 1,929 substances were released in the 1,837 events. For fixed-facilities releases, the three most commonly reported substances categories were other substances (21%), ammonia (19%), and other inorganic substances (15%). Among transportation-related events, other substances (27%), pesticides (25%), other inorganic substances (11%), and volatile organic compounds (9%) were the four most frequently reported categories. Although acids, ammonia, and chlorine together accounted for only 500 (26%) of the events, these substances accounted for more than 38% of the total events with victims. Of the 62 chlorine releases, 21 (34%) resulted in victims.

During the 5-year period, 133 (7%) events resulted in a total of 426 victims, each with one or more verifiable symptoms. One person died. One hundred sixteen (87%) of the events with victims took place at fixed facilities, 17 (13%) were transportation-related. The population groups

most often injured were employees (71%), followed by the general public (12%).

The 426 victims sustained a total of 728 injuries. The three most frequently reported injuries were respiratory irritation (38%), skin irritation (16%), and eye irritation (13%). Most (62%) victims were transported to and treated at a hospital but were not admitted. During 224 events (12% of all events), 15,183 persons left home or work following the release (or threatened release) of one or more hazardous substances.

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Summary of Prevention Outreach Activities and Lessons Learned Based on Cumulative Data

States participating in HSEES were asked to develop at least four strategies to reduce morbidity (injuries) and mortality (deaths) associated with hazardous substances emergencies. Each activity needed (a) to be supported by data from the cumulative analyses and (b) involve a mix of target groups and primary and secondary prevention. Additionally, states were encouraged to collaborate with other local, state, or federal agencies. A number of journal articles have resulted from analysis of the cumulative data as well (APPENDIX A). This section summarizes the prevention outreach activities and the lessons learned, grouped by type of activity.

Overall, states generally feel that it is too soon after completion of the 2000 prevention outreach activities to evaluate their long-term effectiveness in reducing spills and injuries. However, states have measured short-term effectiveness of their prevention outreach activities by counting the number of attendees at a presentation, the number of handouts and fact sheets distributed, the number of requests for additional analyses, and the number of hits on the states' Web pages after publicizing the availability of the Web sites, as well as through evaluation forms filled out by target audiences.

Ammonia

Ammonia releases are most prevalent in the agricultural sector. However, releases also occur in other areas, such as from refrigeration systems in the manufacturing industry.

During the year 2000, eight states conducted various activities related to ammonia. These activities included the following:

1) Six states distributed fact sheets to chicken, meat, and fish processors; county co-operatives; manufacturers; state agencies; and police and other emergency responders.

2) Two states conducted surveys. One survey concerned factors contributing to releases in the poultry and egg industry. The other survey was conducted to assess whether one company's "lessons learned" from HSEES data, which was distributed to 300 companies, would generate data analyses requests from other companies and result in any changes in policy or procedures, process control, engineering design, preventive maintenance schedules, or additional training.

3) Four states had publications in local newspapers, magazines, and journals.

What have we learned?

- Fact sheets were most effective when distributed to first responders such as fire fighters, police, and local HazMat teams. They are used as training tools to improve safety when dealing with ammonia releases. Additionally, they have increased awareness about ammonia thefts, which have the potential to result in severe adverse public health effects. However, the fact sheets did not generate much interest from within the manufacturing industry.

- Surveys distributed to the manufacturing industry resulted in a very low response rate. However, the survey distributed with a “lessons learned” from one company was more successful in terms of receiving requests for a data analysis and “lessons learned” from other companies who responded to the survey, especially if they had a history of frequent substance release.
- Publications in local newspapers and magazines were effective, especially if right after a release event. They helped raise public awareness about the problems associated with the release, and intensified public interest when the release impacted their local area or if there was a potential for a similar event. The publications suggested safety measures when dealing with ammonia releases. They were useful for training local response personnel. The publications are intended to encourage companies to take measures to improve their procedures.

Chlorine

Of all substances reported to the HSEES system, chlorine release events represented the highest proportion of events causing injury. Four states conducted chlorine release activities during 2000. They included:

1) Three states distributed fact sheets to county emergency management agencies, fire departments, other first responders, and industries with a history of chlorine releases. The information included data from toxicological profiles, hazards associated with chlorine release,

recommended safety precautions, suggestions for prevention of releases, and use of proper personal protective equipment.

2) One state presented a poster exhibit to municipal water utility directors and engineers and to hotel/motel swimming pool owners and operators.

What have we learned?

- The response to the fact sheets varied in the different states. One state had only one response, while another had several requests for more information from county emergency management personnel and pool and spa operators. To increase awareness, one state coordinator may repeat this activity next year and mail an evaluation form with each fact sheet to assess its impact on company policies and procedures.
- There is no indication, except for anecdotal feedback, of any further requests for information after the poster exhibit.
- Chlorine is an important substance in terms of adverse public health effects, and, therefore, outreach activities should continue. However, not much positive feedback has been received from recipients of fact sheets and attendees at poster exhibitions, and their long-term effectiveness in reducing chlorine spills and injuries is uncertain. Therefore, more “hands-on” activities, such as collaboration with specific industries and/or special programs, may be needed to supplement these activities.

County-Specific Presentations

Several states conducted county-specific outreach activities to increase awareness about the potential risks for hazardous substance releases in the county area. The following outreach activities were conducted in 2000:

1) Four states presented cumulative and county-specific data to local emergency planning committees (LEPCs), local officials and other local groups in counties with large numbers of events and victims. One county group was presented information from geographic information systems (GIS) mapping of events.

2) One state distributed quarterly reports to the 10 counties with the largest number of events. The reports, distributed to LEPCs and other local emergency management groups provided the number of events, victims, injury outcomes, evacuations, and substances released.

What have we learned?

- The presentations were an opportunity to educate attendees on the existence of the HSEES program and to encourage reporting and data requests.
- The quarterly reports have increased awareness about potential risks for hazardous substance releases at the local level. Local public health agencies and LEPCs have requested additional information on specific events of which they were unaware. Other agencies in surrounding counties have expressed an interest in receiving similar reports.

Cumulative data analyses

Eight states distributed or presented information from their cumulative reports to increase awareness about the HSEES system. Groups who were targeted as part of this outreach activity included fire departments, LEPCs, emergency managers and responders, HazMat teams, industries, hospitals, state agencies, EPA, National Environmental Health Association, and the American Chemical Society. Three states also included information about their Web site in the mailing.

What have we learned?

- Distributing the cumulative report to HSEES contacts in industry demonstrated that their work with the HSEES program has produced tangible results.
- The presentations resulted in first contacts with various agencies for future presentations, data sharing, and other prevention activities. Requests for additional information or presentations were received from several groups.
- GIS was used to emphasize the public health impact of hazardous substances emergency releases, and GIS mapping was used to illustrate the distribution of HSEES events in relationship to hospitals, child care centers, and schools.

Illicit drug laboratories

Releases and adverse health effects from illicit drug laboratories are a growing public health problem. Two states have developed prevention outreach activities for dealing with illicit drug laboratories. One state distributed a fact sheet on illegal methamphetamine laboratories to law enforcement, fire departments, emergency response departments, and other groups who may experience problems with these facilities. Another state developed and presented to various groups recommendations for cleanup of illegal drug laboratory facilities and rehabilitation of their buildings.

What have we learned?

- Requests for additional fact sheets were received from several police and fire departments. Even though law enforcement personnel are often the victims of injuries associated with events at meth laboratories, they felt that the HazMat training they received was adequate. Police officers and other emergency responders at the local level (particularly in small towns) were very receptive to the training and the information.
- By developing recommendations for cleaning up illegal drug laboratories, coordination with other state agencies was established. One state has included a drug laboratory initiative in its budget request for 2001–2002.

Employees/Manufacturers

Several states conducted outreach activities for employees and manufacturers to increase awareness about the health effects of acute exposures to specific chemicals and to prevent or reduce hazardous substances emergency spills. The following activities were conducted in 2000:

- 1) One state developed fact sheets for the five most frequently spilled chemicals. These fact sheets were distributed to facilities that use, handle, transport, manufacture, and/or store any of the five substances.
- 2) One state designed and distributed a booklet to industry which described and summarized hazardous events from 1993 – 1997.
- 3) One state gave targeted presentations to industry management, industrial hygienists, and company HazMat responders for the top manufacturers in their state.
- 4) One state collaborated with a university to evaluate and report on hazardous substance releases in the state by type of industry involved.

What have we learned?

- The fact sheets generated a substantial number of calls from facilities that had questions about the program. These calls highlight the need for significant efforts to increase awareness about and describe the purpose of the HSEES system among various industries in that state.

- Employers who had recently experienced an emergency event were more open to suggestions about how to better protect their workers and neighbors, and therefore avoid liability.
- Distributing industry reports has proven extremely valuable in building trust and opening communication. Industries can see in the reports a tangible product resulting from the time and effort they have expended in contributing to HSEES. Distribution of the industry booklet has resulted in requests for additional information.

Mercury

Mercury outreach activities focused on preventing and reducing mercury releases and adverse health effects in schools. Two states conducted mercury outreach activities during 2000. One state distributed a fact sheet to school nurses. Another state gave a presentation that discussed cleanup costs at several schools where mercury had been spilled to a science teachers association conference.

What have we learned?

- The fact sheet generated two inquiries from school nurses about the proper disposal of mercury thermometers. As a result, the state health department realized that it had no policy in place for the proper disposal of elemental mercury waste. A policy is currently being developed.

- School administrators and principals who attended the presentation were more interested in discussing potential liability issues than clean-up costs. Most science departments are replacing mercury containing equipment with non-mercury alternatives as the mercury equipment breaks, wears out, or becomes obsolete. A complete change out would only occur if funds were made available through a special program.

Pesticides

Pesticide outreach mainly targeted pesticide manufacturers, pesticide users, and state agricultural agencies in agriculturally oriented states. Two states conducted pesticide outreach activities in 2000. After one state's initial mailing of a fact sheet, requests for additional fact sheets were made by fire departments, local emergency planning committees, and the state poison control center. The other state published a summary of data on pesticide releases.

What have we learned?

- Those who plan, prepare for, and respond to pesticide releases were most interested in the fact sheet. Although the fact sheet did not generate much interest from the manufacturing industry, requests for additional and more detailed information were received from other groups.
- The pesticide data summary was originally intended to be presented at Cooperative Extension Service training sessions. Because these meetings generally

have small audiences, presentation of data was determined to be too labor intensive for the small number of individuals reached. Instead, a publication was produced for use at these meetings.

Emergency Responders

To increase awareness about HSEES among first responders and other emergency personnel, several states targeted outreach activities to these groups. The following outreach activities were conducted in 2000:

1) Two states presented information to groups of firefighters. One presentation provided cumulative data while the other presentation focused on events with injuries to responders, particularly to firefighters.

2) Four states gave presentations to first responders and other emergency response personnel (e.g., HazMat teams and Emergency Medical Technicians [EMTs]). The information presented included cumulative data, detailed analyses geared toward first responders, GIS mapping, and ATSDR medical management guidelines.

3) One state prepared several articles discussing injuries and personal protective equipment, the ten chemicals most frequently associated with injuries, and ammonia releases.

4) One state held a workshop regarding HazMat capacity building and outreach to evaluate the state's need for additional HazMat teams.

What have we learned?

- During presentations, it is most useful and effective to discuss events and data geared toward the interests of the audience.
- Sharing information to make responders more aware of their risks may encourage responders to use their PPE appropriately to avoid injury.

The presentations facilitated data collection because of the personal contact with reporting officials.

- The HazMat capacity building workshop brought up problems with lack of reporting and inconsistent definitions of what constitutes a HazMat team. Since the workshop, cumulative data and other information, which emphasized the problems with inconsistent HazMat definitions as well as the lack of reporting to the National Response Center (NRC), were reported to the State Emergency Response Commission (SERC). Suggestions were also made on how to notify local industry using hazardous chemicals about their reporting requirements under the direction of the SERC. A committee has been established to better define a HazMat Team by using the EPA "HazMat Team Planning Guidance." Efforts continue to create a training session for police, fire, and rescue service dispatchers in order to increase reporting to the NRC. Magnets with reporting information will be created and mailed shortly and will be distributed during training sessions for all necessary personnel.

- Feedback and anecdotal information about the publications showed that HSEES data are meaningful to the emergency management and planning community and are viewed as a significant contribution to the publications.

Web site development

Five states have developed or expanded their HSEES Web sites to increase awareness about the HSEES system. Information available on the Web sites includes general information about the HSEES system; the cumulative report; annual reports; prevention outreach activities; fact sheets; quarterly reports; and links to other states, ATSDR, and other agencies that maintain information concerning hazardous substances. The availability of the Web sites was publicized through postcards, fax notices, notices mailed with the cumulative report, and through other similar activities.

What have we learned?

- The Web sites have aided in publicizing the HSEES system, as indicated by the considerable number of hits received by the sites. One state reported more than 1,500 hits.
- Several states have received positive comments about the content of their Web sites.
- The Web sites are a useful tool to educate individuals about the program and to give them access to educational materials.

Wellhead protection

Two states have provided data to other state programs about emergency spills that could potentially affect wellhead sites, watersheds, and other areas at risk for contamination of drinking water. One state provided data on location and chemical information of spills to the Wellhead Protection Program, which uses the information in a GIS layer to develop a wellhead protection area. This information visually indicated where spills occurred in the past and where they might occur in the future. Another state used GIS technology to identify and map releases at high risk sites.

What have we learned?

- Additional analysis of HSEES data was requested to determine if more spills occur at road intersections. As a result, an environmental review of a proposed highway reroute that would have put an intersection in the middle of a sensitive wellhead protection area was conducted.
- By identifying areas at high risk of water contamination, the EPA's Office of Water can enforce limitations on hazardous activities that threaten water supplies.

Most and least effective prevention outreach activities

Activities summarized next are those the states feel were most and least effective in the short-term; these were evaluated on the basis of feedback from target audiences and the ability to solve problems that occurred.

Most effective

Activities that targeted large audiences (such as distributing cumulative reports, industry booklets, and fact sheets) were viewed by states as the most effective. Oral presentations highlighting specific issues of importance to a particular group were also viewed as effective. Additionally, outreach to groups involved in illegal drug laboratories was very effective because of its timeliness. Several states mentioned that communication and building awareness were achieved through these activities, which will help improve the data collection process.

Least effective

Activities viewed by states as least effective often resulted from difficulty in scheduling presentations or lack of interest and cooperation from target audiences. Also viewed as least effective were activities that did not allow for feedback from the target audience. Industry, including manufacturers and users of hazardous substances, were a difficult audience to reach. More innovative activities targeted toward this group, such as providing a company-specific analysis and giving oral presentations, need to be implemented.

Future Activities

In addition to the 1993–1997 cumulative report, HSEES annual reports, fact sheets, and brochures also are available. The public-access HSEES Web site will be available soon for people to download these products. The HSEES program will continue to submit journal articles and present at national conferences.

HSEES will continue to foster its relationship with government and private organizations, including the Centers for Disease Control and Prevention, U.S. Environmental Protection Agency, U.S. Department of Transportation, U.S. Chemical Safety and Hazard Investigation Board, Federal Emergency Management Agency, American Chemistry Council (formerly the Chemical Manufacturers Association), Chlorine Institute, International Institute of Ammonia Refrigeration, and Mary Kay O'Connor Process Safety Center.

Plans to enhance the Web-deployed data entry system to include mapping capabilities are underway. ATSDR will continue to support the states in their efforts to develop new prevention activities and document their efficacy.

APPENDIX A

Publications

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- Weisskopf MG, Drew JM, Hanrahan LP, Anderson HA. Hazardous ammonia releases in Wisconsin: Trends and risk factors for evacuation and injury. *Wisconsin Medical Journal*. November 2000: 30–46.
- Welles WL, Wilburn RE. Hazardous Substances Emergency Events Surveillance (HSEES) in New York State, 1993 to 1997. *Chemical Health and Safety*. January/February 2001: 42–52.
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HSEES DATA REQUEST FORM

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